

U.S. DEPARTMENT OF COMMERCE  
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)  
(formerly National Bureau of Standards-NBS)

PRODUCT STANDARD PS65-75

PAINTS AND INKS FOR ART EDUCATION IN SCHOOLS

Product Standard PS65-75, Paints and Inks for Art Education in Schools, was withdrawn by the U.S. Department of Commerce on July 20, 1982.

\* \* \* \* \*

The following organizations can provide guidance and assistance for copies and additional information on ANSI Z356 standard Art and Craft Materials - crayons (ANSI Z356.1), chalk (ANSI Z356.2), adhesives (ANSI Z356.3), modeling materials (ANSI Z356.4), paints and inks (ANSI Z356.5), and other sources (such as ACMI publications that cover safety and certified products).

Contact:     **Art and Craft Materials Institute (ACMI)**  
                 (formerly Crayon, Water Color and Craft Institute)  
                 100 Boylston Street, Suite 1050  
                 Boston, Massachusetts 02116, USA  
                 Telephone: (617) 426-6400  
                 Fax: (617) 426-6639

**American National Standards Institute (ANSI)**  
11 West 42nd Street, 13th Floor  
New York, New York 10036, USA  
Telephone: (212) 642-4900; Fax: (212) 302-1286 (orders only)  
or Fax: (212) 398-0023; e-mail: info@ansi.org

\* \* \* \* \*

The following ASTM standards may also be of interest: D4236, Standard Practice Labeling Art Materials for Chronic Health Hazards; D4302, Standard Specification for Artists' Oil, Resin-Oil, and Alkyd Paints; D4303, Standard Test Methods for Relative Lightfastness of Pigments Used in Artists' Paints; C1023, Standard Practice for Labeling Ceramic Art Materials for Chronic Adverse Health Hazards, and D5517, Standard Test Method for Determining Extractability of Metals from Art Materials.

These standards are under the jurisdiction of Subcommittee: D01.57, Artist Paints and Related Materials and C21.08, Ceramic Materials for Artists and Hobbyists. For guidance and assistance for copies and additional information and/or committee or subcommittee sources, contact:

Committee D01 on Paints, Related Coatings, Materials and Applications  
Telephone: (610) 832-9717  
Committee C21 on Ceramics Whitewares and Related Products  
Telephone: (610) 832-9730  
Committee Operation Fax Number: (610) 832-9666

**American Society for Testing and Materials (ASTM)**  
100 Barr Harbor Drive  
West Conshohocken, Pennsylvania 19428-2959, USA  
General Inquiries/Orders: (610) 832-9500/-9585; Fax: (610) 832-9555  
E-Mail: service@local.astm.org



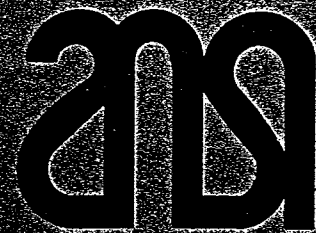
# Voluntary Product Standard

# WITHDRAWN

## PS 65-75

U.S. DEPARTMENT OF COMMERCE/National Bureau of Standards

## PAINTS AND INKS FOR ART EDUCATION IN SCHOOLS



American National  
Standards Institute

American National Standard Z 297.1-1975

## NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards<sup>1</sup> was established by an act of Congress March 3, 1901. The Bureau's overall goal is to strengthen and advance the Nation's science and technology and facilitate their effective application for public benefit. To this end, the Bureau conducts research and provides: (1) a basis for the Nation's physical measurement system, (2) scientific and technological services for industry and government, (3) a technical basis for equity in trade, and (4) technical services to promote public safety. The Bureau consists of the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Institute for Computer Sciences and Technology, and the Office for Information Programs.

**THE INSTITUTE FOR BASIC STANDARDS** provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of the Office of Measurement Services, the Office of Radiation Measurement and the following Center and divisions:

Applied Mathematics — Electricity — Mechanics — Heat — Optical Physics — Center for Radiation Research: Nuclear Sciences; Applied Radiation — Laboratory Astrophysics<sup>2</sup> — Cryogenics<sup>2</sup> — Electromagnetics<sup>2</sup> — Time and Frequency<sup>2</sup>.

**THE INSTITUTE FOR MATERIALS RESEARCH** conducts materials research leading to improved methods of measurement, standards, and data on the properties of well-characterized materials needed by industry, commerce, educational institutions, and Government; provides advisory and research services to other Government agencies; and develops, produces, and distributes standard reference materials. The Institute consists of the Office of Standard Reference Materials, the Office of Air and Water Measurement, and the following divisions:

Analytical Chemistry — Polymers — Metallurgy — Inorganic Materials — Reactor Radiation — Physical Chemistry.

**THE INSTITUTE FOR APPLIED TECHNOLOGY** provides technical services to promote the use of available technology and to facilitate technological innovation in industry and Government; cooperates with public and private organizations leading to the development of technological standards (including mandatory safety standards), codes and methods of test; and provides technical advice and services to Government agencies upon request. The Institute consists of the following divisions and Centers:

Standards Application and Analysis — Electronic Technology — Center for Consumer Product Technology: Product Systems Analysis; Product Engineering — Center for Building Technology: Structures, Materials, and Life Safety; Building Environment; Technical Evaluation and Application — Center for Fire Research: Fire Science; Fire Safety Engineering.

**THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY** conducts research and provides technical services designed to aid Government agencies in improving cost effectiveness in the conduct of their programs through the selection, acquisition, and effective utilization of automatic data processing equipment; and serves as the principal focus within the executive branch for the development of Federal standards for automatic data processing equipment, techniques, and computer languages. The Institute consists of the following divisions:

Computer Services — Systems and Software — Computer Systems Engineering — Information Technology.

**THE OFFICE FOR INFORMATION PROGRAMS** promotes optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal Government; promotes the development of the National Standard Reference Data System and a system of information analysis centers dealing with the broader aspects of the National Measurement System; provides appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world. The Office consists of the following organizational units:

Office of Standard Reference Data — Office of Information Activities — Office of Technical Publications — Library — Office of International Relations — Office of International Standards.

<sup>1</sup> Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.

<sup>2</sup> Located at Boulder, Colorado 80302.

U.S. DEPARTMENT OF COMMERCE, Elliot L. Richardson, *Secretary*  
James A. Baker, III, *Under Secretary*  
Dr. Betsy Anckor-Johnson, *Assistant Secretary for Science and Technology*

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Acting Director*

## **VOLUNTARY PRODUCT STANDARD PS 65-75**

### **Paints and Inks for Art Education in Schools**

Approved by the American National Standards Institute on  
October 31, 1975, as American National Standard Z297.1-1975

#### **Abstract**

This Voluntary Product Standard covers the establishment of requirements for preservatives, toxicity, coarse particle content, performance, working qualities, and packaging for school paints and inks, and provides producers, distributors, and users with a basis for common understanding of the characteristics of this product.

**Key words:** Art education; inks for art education; paints and inks; schools, paints and inks.

Nat. Bur. Stand. (U.S.), Prod. Stand. 65-75, 7 pages (March 1976)

CODEN: XNPSAX

---

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402  
(Order by SD Catalog No. C13.20/2:65.75), Price 35 cents (Add 25 percent additional for other  
than U.S. mailing.)

# Contents

1. Purpose .....	Page 1
2. Scope .....	1
3. Requirements .....	1
3.1. Material .....	1
3.2. Color .....	1
3.3. Preservatives .....	1
3.4. Toxicity .....	1
3.5. Coarse particle content .....	1
3.6. Working qualities .....	1
3.6.1. Finger paint .....	1
3.6.2. Liquid and powder tempera .....	1
3.6.3. Semimoist water colors .....	2
3.6.4. Water-soluble block printing ink .....	2
3.7. Performance .....	2
3.8. Packaging .....	2
3.8.1. Finger paint .....	2
3.8.2. Liquid tempera .....	2
3.8.3. Powder tempera .....	2
3.8.4. Semimoist water colors .....	2
3.8.5. Water-soluble block printing ink .....	2
4. Inspection and Test Procedures .....	2
4.1. General .....	2
4.2. Preservatives .....	2
4.3. Coarse particle content .....	2
4.4. Performance .....	2
4.4.1. Preparation of paintouts .....	3
5. Identification .....	3
6. Effective Date .....	3
7. History of Project .....	3
8. Standing Committee .....	4
Appendix A—Additional information for purchasers and users of art materials .....	4
Appendix B—Metric conversion factors .....	4

# **VOLUNTARY PRODUCT STANDARDS**

*Voluntary Product Standards* are developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The purpose of the standards is to establish nationally recognized requirements for products, and to provide all concerned interests with a basis for common understanding of the characteristics of the products. The National Bureau of Standards administers the *Voluntary Product Standards* program as a supplement to the activities of the private sector standardizing organizations.

## **Establishment of a VOLUNTARY PRODUCT STANDARD**

The role of the National Bureau of Standards in the establishment of a Voluntary Product Standard is to (1) act as an unbiased coordinator in the development of the standard, (2) provide editorial assistance in the preparation of the standard, (3) supply such assistance and review as is required to assure the technical soundness of the standard, (4) seek satisfactory adjustment of valid points of disagreement, (5) determine the compliance with the criteria of the Department's procedures, (6) provide secretarial functions for each committee appointed under the Department's procedures, and (7) publish the standard as a public document.

Producers, distributors, users, consumers, and other interested groups contribute to the establishment of a *Voluntary Product Standard* by (1) initiating and participating in the development of the standard, (2) providing technical or other related counsel as appropriate relating to the standard, (3) promoting the use of and support for the standard, and (4) assisting in keeping the standard current with respect to advancing technology and marketing practices.

## **Use of a VOLUNTARY PRODUCT STANDARD**

The use of a *Voluntary Product Standard* is voluntary; the National Bureau of Standards has no regulatory power in the enforcement of the provisions of the standards. However, since the standards represent a consensus of all interested groups, their provisions are likely to become established as trade customs. In addition, when a standard is made a part of a legal document, such as a sales contract or code, compliance with the standard is enforceable.

The benefits derived from *Voluntary Product Standards* are in direct proportion to their general recognition and actual use. Producers and distributors whose products meet the requirements of a *Voluntary Product Standard* may refer to the standard in advertising and on labels to promote greater public understanding of or confidence in their products. Purchasers may order products conforming to the requirements of the standards.

For copies of the *Voluntary Product Standards* procedures or for more information concerning the development and use of these standards you may write to: Standards Development Services Section, National Bureau of Standards, Washington, D.C. 20234.

# Paints and Inks for Art Education in Schools

Effective November 15, 1975 (See section 5.)

(This Standard, which was initiated by The Crayon, Water Color and Craft Institute, Inc., has been developed under the *Procedures for the Development of Voluntary Product Standards* of the U.S. Department of Commerce as a revision of the school paint portions of Commercial Standard CS 130-60, *Color Materials for Art Education in Schools*, and Simplified Practice Recommendation R 192-63, *Crayons, Chalks, and Related Art Materials for School Use*.)

## 1. PURPOSE

The purpose of this Voluntary Product Standard is to establish nationally recognized quality requirements and package sizes for paints and inks used for art education in schools and to provide producers, distributors, and users with a basis for common understanding of the characteristics of these products.

## 2. SCOPE AND CLASSIFICATION

**2.1. Scope**—This Voluntary Product Standard provides requirements for the material, shelf life, toxicity, coarse particle content, working qualities, performance, and packaging of school paints and inks. Methods of identifying products that conform to the Standard are included.

**Note:** As an aid in correlating U.S. customary units to metric units, conversion factors for the units used in this Standard are given in appendix B.

**2.2. Classification**—This Standard covers the following five types of paints and inks:

- Finger paint
- Liquid tempera
- Powder tempera
- Semimoist water colors
- Water-soluble block printing inks

## 3. REQUIREMENTS

**3.1. Material**—All products shall be water dispersible. Finger paint and block printing ink shall be ready for use as received. Liquid tempera shall be ready for use when thoroughly mixed, powder tempera shall be ready for use when mixed with water, and semimoist water colors shall be ready for use when moistened.

**3.2. Color**—The color of the paints or inks shall be as specified by the buyer and agreed upon by the seller.

**3.3. Preservatives**—There shall be no evidence of decomposition, scum, or mold growth when the product is tested in accordance with 4.2.

**3.4. Toxicity**—No product covered by this Standard shall contain any materials in quantities that may be toxic or injurious to the human body even if the product is ingested in a large single dose up to 8 ounces or in multiple small doses (e.g., as in fingerlicking) the equivalent of 1/2 teaspoon daily up to 6 months.<sup>1</sup> Advice concerning the appropriateness of specific materials may be obtained from the Bureau of Biomedical Science, Consumer Product Safety Commission, Washington, D.C. 20407.

**3.5. Coarse particle content**—The coarse particle content of the product retained on a 3 inch No. 325 (45- $\mu$ m) sieve shall be no more than 0.5 percent when tested in accordance with 4.3.

**3.6. Working qualities**—The various colors of ink and of each type of paint shall intermix with themselves to readily produce intermediate colors.

**3.6.1. Finger paint**—The paint shall have a smooth, creamy consistency.

**3.6.2. Liquid and powder tempera**—The tempera shall brush easily, adhering evenly on white drawing paper and shall dry to an opaque matte finish.

<sup>1</sup> At the present time, insufficient data exists to determine a safe limit for lead in paint; therefore, it is recommended that no lead compounds be intentionally added to art materials for school use.

**3.6.3. Semimoist water colors**—The water colors shall lift readily with a wet brush and shall dry to a uniform transparent matte finish.

**3.6.4. Water-soluble block printing ink**—The ink shall print uniformly when applied to drawing paper and shall dry to an opaque, matte finish.

**3.7. Performance**—The product shall show no visual signs of chipping, peeling, or cracking when tested in accordance with 4.4.

**3.8. Packaging**—Except for semimoist water colors, each container of paint or ink shall bear the name of the color it holds. The color in refill containers of semimoist water colors shall be marked on the outside of the container. Powder tempera containers shall also bear instructions for mixing the contents.

**3.8.1. Finger paint**—The paint shall be packaged in glass, plastic, or other suitable containers having a net content of 2, 4, 8, 16 (one pint), 32 (one quart), 64 (one-half gallon), or 128 (one gallon) fluid ounces.

**3.8.2. Liquid tempera**—The paint shall be packaged in suitable containers including those having a net content of  $\frac{3}{4}$ , 1,  $1\frac{1}{8}$ , 2, 8, 16 (one pint), 32 (one quart), 64 (one-half gallon), or 128 (one gallon) fluid ounces.

**3.8.3. Powder tempera**—The paint shall be packaged in containers equipped with a reclosable opening and shall have a net weight of 1 pound or 5 pounds.

**3.8.4. Semimoist water colors**—The paints shall be packaged in pans in accordance with table 1, or in equivalent volumes in cavities in plastic strips. If in pans, the pans shall be individually removable from their containers. If in cavities in plastic strips, the cavities shall be of a size to accommodate refill pans, and the strips shall be removable from their containers. Colors other than refills shall be packaged in boxes with lids. Refills shall be packaged in pans or in plastic strips.

TABLE 1. Size of pans

Package	Approximate inside dimensions		
	Length (inch)	Width (inch)	Depth (inch)
Half pans * -----	$\frac{3}{4}$	$\frac{9}{16}$	$\frac{1}{4}$
Full pans -----	$1\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{4}$

\* Or oval or round pans containing a volume of material equivalent to that held by the half pans.

**3.8.5. Water-soluble block printing ink**—The ink shall be packaged in metal or plastic tubes or other suitable containers having a net content equivalent to 1,  $1\frac{1}{4}$ ,  $2\frac{1}{2}$ , 5, and 8 fluid ounces; and 1 pound can, avoirdupois.

#### 4. INSPECTION AND TEST PROCEDURES

**4.1. General**—The inspection and test procedures contained in this section are to be used to determine the conformance of products to the requirements of this Voluntary Product Standard. Each producer or distributor who represents his products as conforming to this Standard may utilize statistically based sampling plans which are appropriate for each particular manufacturing process but shall keep such essential records as are necessary to document with a high degree of assurance his claim that all of the requirements of this Standard have been met. Additional sampling and testing of the product, as may be agreed upon between purchaser and seller, is not precluded by this section.

**4.2. Preservative**—The effectiveness of paint and ink preservatives should be tested as follows. Cover several pieces of bread with a sugar and water solution containing 5 percent sugar by weight, and allow time to stand exposed for 24 hours. Cover them and keep them at room temperature until a substantial area is moldy. (This will require approximately a week to 10 days.) Select two moldy pieces, each approximately  $\frac{1}{4}$  inch in diameter, from the bread and push them lightly into the surface of the material being tested. Assure there is good wet contact, but do not submerge the mold in the product. Cover the test sample so as to avoid excessive evaporation and to provide subdued lighting. Allow the sample to remain in this state for 2 weeks, then inspect the sample for decomposition, scum, and mold growth.

**4.3. Coarse particle content**—The coarse particle content shall be determined in accordance with section 6, *Procedure for Water-Soluble Pigments, Pastes in Oil, Pastes, in Japan, and Mixed Paints*, in American Society for Testing and Materials (ASTM) D 185-72, *Standard Methods of Test for Coarse Particles in Pigments, Pastes, and Paints*.<sup>2</sup> The exception is that water shall be substituted for kerosene as a flushing vehicle or solvent.

**4.4. Performance**—Using paintouts prepared as specified in 4.4.1, place the specimens in a controlled atmosphere of  $73 \pm 3$  °F and relative humidity of  $50 \pm 5$  percent. After 14 days, inspect the specimens for compliance with 3.7.

<sup>2</sup> Later issues of this publication may be used providing the requirements are applicable and consistent with the issue designated. Copies of ASTM publications are available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

**4.4.1. Preparation of paintouts**—All paintouts shall be completely dry before testing. Paintouts shall be prepared as follows; where drawing paper is specified, white textured drawing paper with an 80-pound basis weight shall be used:

**a. Finger paint**—Spread the finger paint on wet finger paint paper.

**b. Liquid tempera**—Mix liquid tempera thoroughly to insure uniformity. Paint out on drawing paper.

**c. Powder tempera**—For test purposes, mix one part tempera to one part water (by weight) and stir thoroughly to insure uniformity. Paint out on drawing paper.

**d. Semimoist water colors**—Paint out on drawing paper.

**e. Water-soluble block printing ink**—Using a brayer and block, apply the ink to drawing paper.

## 5. IDENTIFICATION

In order that purchasers may identify products conforming to all requirements of this Voluntary Product Standard, producers and distributors may include a statement of compliance in conjunction with their name and address on product labels, invoices, sales literature, and the like. The following statement is suggested when sufficient space is available:

This (paint or ink) conforms to the requirements established in Voluntary Product Standard PS 65-75, developed cooperatively with the industry and published by the National Bureau of Standards under the *Procedures for the Development of Voluntary Product Standards* of the U.S. Department of Commerce. Full responsibility for the conformance of this product to the standard is assumed by (name and address of producer or distributor).

The following abbreviated statement is suggested when available space on labels is insufficient for the full statement:

Conforms to PS 65-75, (name and address of producer or distributor).

## 6. EFFECTIVE DATE

The effective date of this Voluntary Product Standard is the date upon which reference to the Standard may be made by producers, distributors, users and consumers, and other interested parties. Compliance by producers with all of the requirements of this voluntary standard may not actu-

ally occur until some time after its effective date. Products shall not be represented as conforming to this Voluntary Product Standard until such time as all requirements established in the Standard are met. The effective date of this Standard is November 15, 1975. After this date, products shall not be labeled as conforming to the superseded standards, CS130-60 and R192-63.

## 7. HISTORY OF PROJECT

In 1962, The Crayon, Water Color and Craft Institute, Inc., requested a revision of Commercial Standard CS 130-60, *Color Materials for Art Education in Schools*, to include school paste and block printing ink. The first revision was rejected primarily on the grounds that no preservative requirements were included for paste, and no chroma requirements existed for block printing inks. It became apparent during these early development stages that certain aspects of the original document had become obsolete, and that different test procedures were needed in many areas for the various products to be covered by the standard. The entire project was reviewed in late 1967, and it was then deemed appropriate to combine the requirements of CS 130-60 and Simplified Practice Recommendation R 192-63, *Crayons, Chalks, and Related Art Materials for School Use (Types, Sizes, Packaging and Colors)*, and to develop individual standards for (1) paints and inks, (2) chalk, and (3) school paste.

Committees were established in 1968. After rejecting several draft proposals, the Standard Review Committee approved the proposed Voluntary Product Standard for paints and inks in October 1973. That recommended standard was circulated for acceptance in January 1974. Based on comments received from that mailing and subsequent circulation in October 1974, changes were incorporated into a new draft proposal. The revised document was unanimously approved by the Standard Review Committee in March 1975, and the standard was again circulated in April 1975 to producers, distributors, users and consumers, and others interested in the product to determine its acceptability. An analysis of the response to that circulation indicated a consensus as defined in the published procedures.

The new standard was designated Voluntary Product Standard PS 65-75, *Paints and Inks for Art Education in Schools*, and became effective November 15, 1975.

*Technical Standards Coordinator:*

George S. Chaconas

Standards Development Services Section

National Bureau of Standards

Washington, D.C. 20234

## 8. STANDING COMMITTEE

A Standing Committee has been appointed to assist in keeping this Voluntary Product Standard up to date. The names and members of the committee are available from the Standards Development Services Section, National Bureau of Standards, Washington, D.C. 20234, which serves as the secretariat of the committee.

### APPENDIX A. ADDITIONAL INFORMATION FOR PURCHASERS AND USERS OF ART MATERIALS

**A1. Reference to Voluntary Product Standards**—Voluntary Product Standards are most effective when they are adopted by industry as recognized trade practice. Purchasers and users of school art materials can promote the adoption and use of this Standard by referencing it in their specifications and purchase orders.

For example, the Standard can be referenced as part of the specifications for individual products in the invitation to bid:

Item No.	Article Description	Unit	No. of Units
05-16-035	Block printing ink, 1 oz tubes waterbase, certified to comply with Voluntary Product Standard PS 65-75.		
05-16-038	Black	ea.	3400
	Blue	ea.	2400
	Paint, liquid tempera, quart, certified to comply with Voluntary Product Standard PS 65-75.		
05-26-001	Red	ea.	100
05-26-003	Yellow	ea.	100
05-26-005	Blue	ea.	100

Or, a paragraph similar to the following can be added to the *General Conditions* section of the invitation to bid:

#### Standards

Unless otherwise specified, the products ordered shall comply with Voluntary Product Standard PS 30-70, *School Chalk*, and PS 65-75, *Paints and Inks for Art Education in Schools*, where applicable.

Or, if additional assurance is required the purchaser can further request in the *General Conditions* section:

The packages of products covered by these standards shall be marked to indicate the product's compliance with the applicable

standard (or "A certificate of compliance with the applicable standard shall be included with each shipment of products covered by these standards.").

**A2. Color**—Color deserves special mention because it is the essence of art materials. Ideally, the purchase of intense colors is desirable as they are more than just "pretty," they are economical. With intense color as a base, all that is needed is the addition of white or black to get a wide variety of tints or shades. True primary colors also mix better with one another to form secondary colors.

Intense color in a paint or ink usually indicates more pigment in the product. Consequently, the economics of buying intense colors is apparent.

Unfortunately, there are limitations on the degree of intensity obtained in a paint or ink intended for school use. Certain pigments, for example, produce brilliant colors, but at the same time they may be toxic. Because of new data on existing ingredients, new ingredients, and the changing availability of ingredients, manufacturers often find it necessary to reformulate. In some instances, the intensity and even the hue of the color may be affected. For these reasons, paints and inks meeting the toxicity requirements of this Standard and having intense, clear colors will give greater economy and satisfaction.

### APPENDIX B. METRIC CONVERSION FACTORS

The conversion factors and units contained in this appendix are in accordance with the International System of Units (abbreviated SI for *Système International d'Unités*). The SI was defined and given official status by the 11th General Conference on Weights and Measures which met in Paris in October 1960. For assistance in converting U.S. customary units to SI units, see ASTM E 380, *ASTM Standard Metric Practice Guide*, available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. The conversion factors for the units found in this Standard are as follows:

1 inch	= 25.4 millimeters
1 ounce (avdp)	= 28.35 grams
1 pound (avdp)	= 0.45 kilogram
1 fluid ounce	= 29.57 milliliters
1 teaspoon	= 5 milliliters
1 quart (liquid)	= 0.95 liter

$$t_c = (t_F - 32)/1.8$$

where:  $t_c$  = temperature in degrees Celsius  
 $t_F$  = temperature in degrees Fahrenheit

# NBS TECHNICAL PUBLICATIONS

## PERIODICALS

**JOURNAL OF RESEARCH** reports National Bureau of Standards research and development in physics, mathematics, and chemistry. It is published in two sections, available separately:

### • Physics and Chemistry (Section A)

Papers of interest primarily to scientists working in these fields. This section covers a broad range of physical and chemical research, with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Issued six times a year. Annual subscription: Domestic, \$17.00; Foreign, \$21.25.

### • Mathematical Sciences (Section B)

Studies and compilations designed mainly for the mathematician and theoretical physicist. Topics in mathematical statistics, theory of experiment design, numerical analysis, theoretical physics and chemistry, logical design and programming of computers and computer systems. Short numerical tables. Issued quarterly. Annual subscription: Domestic, \$9.00; Foreign, \$11.25.

**DIMENSIONS/NBS** (formerly Technical News Bulletin)—This monthly magazine is published to inform scientists, engineers, businessmen, industry, teachers, students, and consumers of the latest advances in science and technology, with primary emphasis on the work at NBS. The magazine highlights and reviews such issues as energy research, fire protection, building technology, metric conversion, pollution abatement, health and safety, and consumer product performance. In addition, it reports the results of Bureau programs in measurement standards and techniques, properties of matter and materials, engineering standards and services, instrumentation, and automatic data processing.

Annual subscription: Domestic, \$9.45; Foreign, \$11.85.

## NONPERIODICALS

**Monographs**—Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

**Handbooks**—Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

**Special Publications**—Include proceedings of conferences sponsored by NBS, NBS annual reports, and other special publications appropriate to this grouping such as wall charts, pocket cards, and bibliographies.

**Applied Mathematics Series**—Mathematical tables, manuals, and studies of special interest to physicists, engineers, chemists, biologists, mathematicians, computer programmers, and others engaged in scientific and technical work.

**National Standard Reference Data Series**—Provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated. Developed under a world-wide

program coordinated by NBS. Program under authority of National Standard Data Act (Public Law 90-396).

**NOTE:** At present the principal publication outlet for these data is the Journal of Physical and Chemical Reference Data (JPCRD) published quarterly for NBS by the American Chemical Society (ACS) and the American Institute of Physics (AIP). Subscriptions, reprints, and supplements available from ACS, 1155 Sixteenth St. N. W., Wash. D. C. 20056.

**Building Science Series**—Disseminates technical information developed at the Bureau on building materials, components, systems, and whole structures. The series presents research results, test methods, and performance criteria related to the structural and environmental functions and the durability and safety characteristics of building elements and systems.

**Technical Notes**—Studies or reports which are complete in themselves but restrictive in their treatment of a subject. Analogous to monographs but not so comprehensive in scope or definitive in treatment of the subject area. Often serve as a vehicle for final reports of work performed at NBS under the sponsorship of other government agencies.

**Voluntary Product Standards**—Developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The purpose of the standards is to establish nationally recognized requirements for products, and to provide all concerned interests with a basis for common understanding of the characteristics of the products. NBS administers this program as a supplement to the activities of the private sector standardizing organizations.

**Federal Information Processing Standards Publications (FIPS PUBS)**—Publications in this series collectively constitute the Federal Information Processing Standards Register. Register serves as the official source of information in the Federal Government regarding standards issued by NBS pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89-306 (79 Stat. 1127), and as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973) and Part 6 of Title 15 CFR (Code of Federal Regulations).

**Consumer Information Series**—Practical information, based on NBS research and experience, covering areas of interest to the consumer. Easily understandable language and illustrations provide useful background knowledge for shopping in today's technological marketplace.

**NBS Interagency Reports (NBSIR)**—A special series of interim or final reports on work performed by NBS for outside sponsors (both government and non-government). In general, initial distribution is handled by the sponsor; public distribution is by the National Technical Information Service (Springfield, Va. 22161) in paper copy or microfiche form.

Order NBS publications (except NBSIR's and Bibliographic Subscription Services) from: Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

## BIBLIOGRAPHIC SUBSCRIPTION SERVICES

The following current-awareness and literature-survey bibliographies are issued periodically by the Bureau:

**Cryogenic Data Center Current Awareness Service**

A literature survey issued biweekly. Annual subscription: Domestic, \$20.00; foreign, \$25.00.

**Liquefied Natural Gas.** A literature survey issued quarterly. Annual subscription: \$20.00.

**Superconducting Devices and Materials.** A literature

survey issued quarterly. Annual subscription: \$20.00. Send subscription orders and remittances for the preceding bibliographic services to National Bureau of Standards, Cryogenic Data Center (275.02) Boulder, Colorado 80302.

**Electromagnetic Metrology Current Awareness Service** Issued monthly. Annual subscription: \$24.00. Send subscription order and remittance to Electromagnetics Division, National Bureau of Standards, Boulder, Colo. 80302.